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smooth ellipse of eccentricity e and latus rectum $2l$. The string is held taut and horizontal, then released; find the velocities of the beads when the end ones impinge.

NUMBER THEORY.

274. Proposed by J. L. RILEY, Stephenville, Texas.

Solve in positive integers the equation

$$x^4 + x^3 + x^2 + x + 1 = y^2.$$

275. Proposed by V. M. SPUNAR, Chicago, Illinois.

A square, side $2a$, is represented by the equation $x^n + y^n = a$ $(n = \infty)$. Find a like formula for an equilateral triangle.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

480. Proposed by FRANK IRWIN, University of California.

Solve the following equation

$$(x-1) - 2\left(1-\frac{1}{x}\right) - 3\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right) - 4\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\left(1-\frac{3}{x}\right) - \cdots - n\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\cdots\left(1-\frac{n-1}{x}\right) = 0.$$

Also the equation

$$(x-a_1) - a_2\left(1-\frac{a_1}{x}\right) - a_3\left(1-\frac{a_1}{x}\right)\left(1-\frac{a_2}{x}\right) - \cdots - a_n\left(1-\frac{a_1}{x}\right)\left(1-\frac{a_2}{x}\right)\cdots\left(1-\frac{a_{n-1}}{x}\right) = 0.$$

[Adapted from a formula of Tait's.]

SOLUTION BY A. M. HARDING, University of Arkansas.

It is evident that

$$(x-1)(x-2) \equiv x(x-1) - 2(x-1)$$

and

$$(x-1)(x-2)(x-3) \equiv x^2(x-1) - 2x(x-1) - 3(x-1)(x-2).$$

Let us assume that

$$(x-1)(x-2)\cdots(x-n+1) \equiv x^{n-2}(x-1) - 2x^{n-3}(x-1) - 3x^{n-4}(x-1)(x-2) - \cdots - (n-1)(x-1)(x-2)(x-3)\cdots(x-n+2). \quad (1)$$

If we multiply both members of this equation by $x - n$ and rearrange the terms we obtain

$$(x-1)(x-2)\cdots(x-n+1)(x-n) \equiv x^{n-1}(x-1) - 2x^{n-2}(x-1) - 3(x-1)(x-2) - \cdots - n(x-1)(x-2)(x-3)\cdots(x-n+1).$$

Hence, equation (1) is true for every value of n.

After dividing both members of the last equation by x^{n-1}, we find

$$\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\left(1-\frac{3}{x}\right)\cdots\left(1-\frac{n}{x}\right) \equiv (x-1) - 2\left(1-\frac{1}{x}\right) - 3\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right) - \cdots - n\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\cdots\left(1-\frac{n-1}{x}\right).$$

Hence, the roots of the given equation are $x = 1, 2, 3, \cdots, n$.

By a method similar to the one used above, it may be shown that the roots of the second equation are $x = a_1, a_2, a_3, \cdots, a_n$.

Also solved by HORACE OLSON, V. M. SPUNAR, E. F. CANADAY, and C. P. SOUSLEY.